HISTORICAL VIGNETTES IN VASCULAR SURGERY

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Eagle scouting

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The residents all called him "the great bald eagle" because he had suffered alopecia totalis in his early 20s after a febrile illness. He was known to be a brilliant, irascible perfectionist, and I was fortunate to be assigned to his service for two 3-month tours of duty as a surgical resident at Mass General Hospital (MGH) in the late 1950s. Robert R. Linton had been born on the Clyde bank in Scotland but grew up and was educated through his undergraduate years in the State of Washington before entering Harvard Medical School. Since I was also a Washingtonian, this gave us at least one thing in common, which was a true blessing in the early days on his service where new residents were subjected to criticism of much that they did. "Nooo, you've got to do it right" was frequently heard and could be demoralizing even though it was often said with a smile. However, if you endured this initiation with reasonable aplomb, things abruptly changed, and you were recruited as his ally against the incompetence, real or perceived, of the nursing staff, the anesthetists, his paid assistant (vascular fellowship was unknown at that time), and a number of his surgical colleagues at the MGH. This immediately made working with Linton a real pleasure for the resident assigned to him if not for others around him (Fig).

Robert R. Linton

Fig. Robert Linton as he looked at the time of this vignette.

I know I learned a great deal from working with several of the senior surgeons at the MGH, but the one who most influenced my subsequent career was Linton. He was devoted to his patients and was a stickler for good patient care. His patients reciprocated, and he was able to cajole many of them into stopping smoking and losing weight before undergoing elective vascular operations. Like many perfectionists, he preferred to do most things himself. He did all his own arteriograms through direct puncture of the common femoral artery with the film placed to display the runoff rather than the obstruction itself. Aortograms were never performed because of fear of nephrotoxicity of contrast medium injected near the renal arteries. He relied on the quality of the femoral pulse to reveal significant aortoiliac obstruction with remarkable accuracy and used plain x-rays to show the location and size of abdominal aneurysms.

In the operating room, Linton had a number of idiosyncrasies, which were for the most part reasonable responses to deficiencies in the operating room (OR) environment in a large hospital. For example, he had the handles of all his instruments gold plated to distinguish them for special handling during cleaning and sterilization. He also purchased several clamp-on wrenches from Sears, which were sterilized and could be clamped on to the handles of the overhead OR lights so that he could adjust the lights himself throughout an operation, thus anticipating the sterile light handles subsequently manufactured and widely used. In an arterial reconstruction, he always gave the heparin himself because of an experience with the wrong dose administered by the anesthetist. He had unshakable self-confidence and would approach big cases with gusto, always sure he had the technical skill to get out of any

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trouble he might encounter. In the 1950s, he was already widely known for his contributions to the management of venous disease and his championing of the splenorenal shunt for the treatment of portal hypertension. He was also clearly a highly experienced abdominal aortic and iliac arterial surgeon. However, what impressed me the most, and was most important to my future career, was his treatment of femoropopliteal occlusive disease.

Linton was one of the first American surgeons to recognize the importance of Jean Kunlin's report in the late 1940s[1] of the use of the great saphenous vein to bypass a femoral artery obstruction. The use of the bypass instead of in-line replacement of the obstructed artery was unusual at that time, but what really distinguished Kunlin's report was his detailed illustration of his anastomotic technique, which consisted of a broad, spatulated end-to-side anastomosis with double-armed fine silk sutures initially placed at both ends so that the surgeon had an excellent view of the first few crucial stitches at the heel-and-toe of the anastomosis. The procedure was completed by running the sutures from both ends to the middle on either side with an assistant exerting some tension on the graft to prevent too much incorporation of the ultrapliable vein wall into the suture line. The goal, of course, was an unobstructed junction of graft to artery with what was thought to be the added advantage of allowing the graft to lie next to and parallel with the artery in the hope of reducing turbulence at the anastomosis.

Linton adapted Kunlin's technique of reversed saphenous vein grafting in the 1950s and immediately achieved excellent early results, which contrasted with the high early failure rate reported by other surgeons at that time who had used saphenous vein as an interposition graft sewn end-to-end to the superficial femoral artery above and below an obstruction. Undeterred, Linton continued to use the reversed end-to-side vein graft performed with what he called the "Kunlin" technique as his preferred method of femoral-popliteal reconstruction. He was an expert in the medial exposure of the distal popliteal artery, a technique not in the repertoire of many surgeons at that time. He had noted that this portion of the popliteal was likely to remain free of significant arteriosclerotic disease and, therefore, a better target for a bypass than the above-knee popliteal. He was fond of showing arteriograms with the knee bent illustrating a vein graft forming a smooth curve in contrast to a fabric graft in another patient, which was severely kinked as it crossed the knee. Linton also believed that the graft should lie as close as possible to the host artery to prevent kinks and twists. This entailed a tunnel between the heads of the gastrocnemius, a maneuver now commonplace but not frequently performed in those days.

Linton preferred to perform the distal vein graft anastomosis first so that he could test its patency and the quality of the runoff by injecting heparinized saline through the proximal end of the graft. However, this meant that the proximal anastomosis often became the most difficult technically because of the possibility of kinks and twists at the suture line and the fact that the small end of the vein graft was sutured to an often thick-walled common femoral artery with the danger of anastomotic narrowing. In extreme instances, Linton's solution to the latter problem was to sew an ellipse of vein to the femoral arteriotomy and then perform the proximal anastomosis of the graft to this "Linton patch." Moreover, I quickly learned that "doing it right" meant not only a well-planned and technically precise operation but also almost incredible persistence. He was fully prepared to redo anastomoses as many times as it took to achieve a result that satisfied him. This persistence was rewarded by the fact that his patients rarely required an emergent trip back to the OR for graft failure. His mantra was "never leave the operating room until you are completely satisfied with the technical result." I tried my best to follow this advice throughout my operative career.

Linton's faith in the femoropopliteal vein graft was fully validated in the report by him and his friend and junior partner Clem Darling to the Society for Vascular Surgery in 1966,[2] which described their entire experience with 295 femoropopliteal vein grafts with a cumulative 5-year patency of 73%. These results were so superior to those reported with any other technique that this paper can truly be said to have moved the field of infrainguinal arterial surgery. For my own part, when I completed my residency and went to work for David Hume at the Medical College of Virginia in 1960, I found there was a large underserved population of mostly black patients with severe peripheral vascular disease destined for amputation. I began to use the Linton-Kunlin vein grafting technique for limb salvage in some of these patients. Hume, who was disappointed with the results he was getting with closed femoral-popliteal endarterectomy, quickly embraced the vein graft as a limb salvage operation. By 1963, I reported to the Society for Vascular Surgery our initial experience with vein grafts in these patients with good early limb salvage and patency of the grafts, a few of which were carried to the crural arteries. I was pleased to see Linton in the front row. He commented favorably on our work and afterward put his arm around my shoulder and said, "John, it's a good start." Needless to say, I will always be grateful for the time I spent with the "great bald eagle."

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